THE FORAGE RESOURCES OF LATIN AMERICA

PERU

by

HUGO W. ALBERTS

BULLETIN 37

of the

IMPERIAL BUREAU OF PASTURES AND FORAGE CROPS
ABERYSTWYTH, GREAT BRITAIN
prepared in association with the
TECHNICAL COLLABORATION BRANCH
OFFICE OF FOREIGN AGRICULTURAL RELATIONS
UNITED STATES DEPARTMENT OF AGRICULTURE

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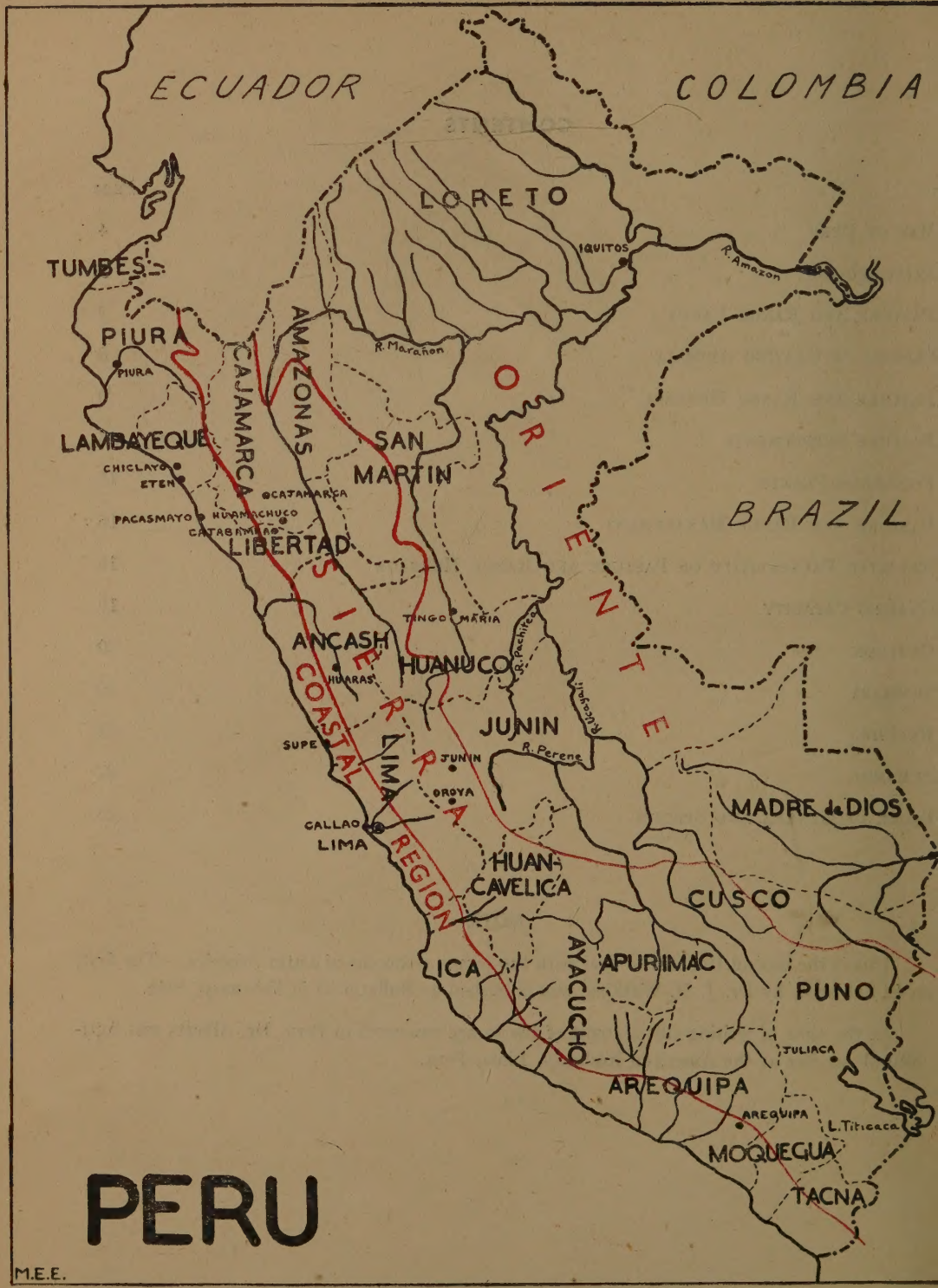
NOTE

This is the second Bulletin to deal with the forage resources of Latin America. The first, on El Salvador, by Dr. J. M. Watkins, was published as Bulletin 35 in February, 1946.

At the time of writing this account of the forage resources of Peru, Dr. Alberts was Agricultural Adviser at the American Embassy, Lima, Peru.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INTRODUCTION

Since remote times, the Andean Indians of Peru have grazed llamas and alpacas, native to the grasslands of the sierra. These animals had been domesticated and raised for their meat and hides by the time the Spaniards arrived. The llamas were used also as pack animals. Fortunately, on account of the nature of the grasses in many of the mountain valleys, there was always some grazing even in the driest times because there were two general types of forage, consisting of short grasses, fairly high in palatability, and tall grasses, comparatively low in palatability. The tall grasses were not eaten during the rainy season when there were plenty of more palatable short grasses and consequently were left in reserve for the winter months and periods of drought.

PASTURE AND RANGE LANDS

Of the total area of Peru, comprising approximately 1,250,000 square kilometres, it is estimated that cultivated pastures and lands planted to hay, soiling and silage crops comprise approximately 15,000 square kilometres ; and native grasslands or range lands which are grazed regularly or intermittently constitute probably more than 200,000 square kilometres. The cultivated pastures are planted to alfalfa, para grass or ryegrass. Although the native grasslands or ranges are distributed throughout Peru, most of them are in the sierra. Those of the coast are found principally in the valleys of the rivers that cross the desert, and those of the oriente or montaña region in Eastern Peru are found in the clearings of the forests and in the savannah areas.

Grazing lands of the coastal area

The grazing lands of the coast comprise those areas in the northern part of the country supplied by waters from natural rainfall, the loma* regions supplied by moisture from the mists or " garuas", the non-irrigated parts of the coastal river valleys supplied by river water through subterranean seepage, and the irrigated lands in the coastal region planted to pasture crops.

Grazing lands in the coastal region of rainfall.—This coastal region supplied by moisture from rains is in northern Peru, extending as far south as Pacasmayo. The rains come only during the months of January to March and even during these months the rainfall is not the same in amount from year to year. On account of the extreme drought during more than half of each year, the grass vegetation is characterized by annuals which make rapid growth during the rainy season, and then produce seeds to carry them over the dry season. It is reported that the limit of pasture area is 10 kilometres from the rivers or other places where goats may obtain water to drink.

Grazing areas of the loma region.—The grazing areas in the loma region comprise certain areas from 200 to 1,000 metres above sea level. The precipitation resulting from the garuas in

* The term *loma* is applied in Peru to any area of level or gently sloping land between the Andes Mountains and the Pacific Ocean. During a part of the year some of the lomas receive sufficient moisture through mists to support vegetation. During the remainder of the year they are barren. Analogous areas in the sierra are known as *punas*.

the Lomas de Lachay was 260 millimetres in 1942 and 172 millimetres in 1943. The moisture content of the soil during the period of the garuas when one of the tests was made was slightly over 3 per cent. The garuas occur generally from the month of September to the month of November. The entire surface of the loma area is green during this period, and barren during the remainder of the year. The lomas comprise more than 40,000 hectares along the coast. (*Est. Exp. Agr. La Molina Mem.* 13a : 30 : 1940, and *Colonias y Foresta* 1 (2 and 3) : 32-44 : 1944.) Beef cattle and goats are the chief grazing animals on these areas. In one of the loma regions of Atiquipa in the Department of Arequipa, it has been reported that several thousand burros (donkeys) run wild. (*La Vida Agr.* 20 : 156 : 1943.)

Grazing areas supplied by subterranean moisture.—These areas are located along the coast between 7° and 15° south latitude. They comprise approximately 30,000 hectares of grass-covered lands supplied with moisture by subterranean water which enters the desert soils laterally through infiltration from the river beds. The subterranean water table may be as deep as two metres or may come to the surface in some places to form freshwater ponds or even lakes. Such areas are too dry to be used as croplands when the water table is low, and too wet where it is high. Grasses found on such areas are used for pasturing principally goats and beef cattle.

Pastures on irrigated lands.—Pastures on irrigated lands generally must compete with other crops of great economic value. Where the soils are not too sandy, too saline, or too shallow, they are generally utilized for growing such crops as cotton, sugar cane, rice or maize on the coast. Frequently a considerable amount of pasturage is obtained by permitting the livestock to graze the weedy herbage on harvested rice fields or cotton fields. The cultivated pastures contain alfalfa, *Medicago sativa*, or para grass, *Panicum purpurascens*. In 1940, a number of animals, principally oxen, were reported to have been poisoned by arsenical dusts which had been applied by plane to control cotton insects, but which had been blown by the wind to neighbouring areas. The oxen were harmed through inhaling the arsenical dust through the respiratory organs and through eating the poisons which had collected on the forage. (*La Vida Agr.* 17 : 549 : 1940.)

Grazing lands of the sierra region

The sierra region comprises all the terrain of the great Andean mountain range, from 2,000 metres above sea level to the summits. With regard to altitude, the sierra comprises three levels, known as the sierra proper between altitudes of 2,000 metres and 3,500 metres ; the puna, between 3,500 metres and 4,500 metres ; and the cordillera or white range above 4,500 metres. The peaks of the cordillera are covered with perpetual snow. There are, however, inter-Andean valleys which are less than 2,000 metres above sea level.

Sierra proper.—The grazing areas of the sierra proper are designated in general according to their topography as quebradas or canyons ; laderas or mountain sides ; cerros or hilltops ; and pampas or plains.

The grazing lands in the quebradas are generally on irrigated lands if irrigation water is available.

In some sections the unirrigated laderas or mountain sides are planted to crops which grow during the 4 months of rainy season, and are idle during the arid months. The lowlands are irrigated in order to provide pasturage throughout the year. In some mountain valleys, as in the Department of Huancavelica and Ayacucho, water is not available for irrigation and seasonal rains are insufficient for the growth of grasses throughout the year ; the pasturage is insufficient for sheep. Goats are raised in these regions, feeding on pasturage for part of the year and browsing on range lands for the remainder of the year.

The grazing lands of the laderas are frequently abandoned croplands, too poor in fertility and too severely eroded to continue to produce the potatoes, barley, wheat, or other crops adapted to the region. The hilltops which are too rocky for cultivation and the plains which cannot be irrigated are utilized as grazing lands.

Puna.—The puna is comparatively flat terrain, alternating with lagoons, river and marshy areas. The prairie-like areas are covered with numerous species of grasses. In general the climate of the puna is cold, with a mean annual temperature of 11° Centigrade. During the rainy season from October to April, the temperature fluctuates from 5° to 25° C. The dry season, which should be the winter season in this hemisphere, is characterized by warm sunny days and frosty nights. On account of its warm days, the dry season is regarded locally as the summer season and the rainy season as the winter season.

The principal puna areas of the country are the regions of Layo, Langui and Lake Titicaca in the south; Parinacochas and Castrovirreyna, Department of Huancavelica, in the south central part; near Junin, Department of Junin in the central part; and Huamachuco and Cajabamba in the north.

Cordillera.—The cordillera has a glacial climate. The lower altitudes are free from snow for part of the year. The length of time when the areas are covered with snow varies directly with the altitude.

Grazing lands of the oriente

The oriente or region east of the Andes Mountains comprises the selvas or lowland forests, known as montaña baja; and the foothills known as montaña alta or ceja de montaña (brow of the mountain). The entire oriente is generally known as "La Montaña." Most of the area is in tropical forests. There are some savannahs, known locally as "pajonales", and also some river valleys which have grasslands. Other grazing areas are on small cleared tracts of land. The selva region comprises the lowlands and extends to an altitude of perhaps 200 metres and the montaña alta from 200 to 2,000 metres.

Savannah grazing lands.—The savannah grazing lands are in areas which have only a few scattered trees with grasses among them. Such lands are burned over periodically. Some extensive areas are found in the Department of Junin. One such area, known as "Gran Pajonal," is more than 10,000 square kilometres in area, is triangular in shape, and bounded by the Rivers Pichez, Pachitea, Ucayali, Tambo and Perene. Not all the area is grass-covered, however. Trees are scattered through parts of it and in some sections where conditions are favourable for tree growth, entire valleys are forest-covered. One of the reasons for not utilizing these areas is their inaccessibility. (Paz Soldan, *Geog. Econ. del Peru.* 1943. p. 70.)

River bottom lands.—Some pastures are found on river bottom lands subject to flooding. Grasses are found on such areas during part of the year, and they are inundated during the remainder.

Cultivated pastures.—Pastures on cultivated lands in the oriente are relatively few. The land is difficult to clear, but when cleared grasses grow readily. The favoured method of clearing land for pasture is to cut the trees in the wet season, allow them to dry, and then burn them near the close of the dry season.

CLASSES OF GRAZING ANIMALS

The classes of grazing animals vary with the regions, being based upon climatic conditions, availability of feed and opportunities for marketing.

Classes of livestock in the coastal area

Goats, dairy cattle, beef cattle, sheep, horses, donkeys and hogs graze in the coastal area. The Spaniards introduced camels in the 16th century, but they did not thrive. Llamas and alpacas are not found along the coast nor in the oriente.

Goats.—Goats are the principal grazing and browsing animals in the region near Piura. The animals feed on the annual grasses following the rainy season and on browse for the rest of the year, or they are utilized to clean cultivated land.

Dairy cattle.—There are two classes of dairy cattle along the coast: (1) improved dairy stock such as Holsteins or Brown Swiss; and (2) native or criollo stock, originally introduced from Spain. The improved dairy stock produces much better yields, but requires more care than the criollo stock. The latter consists of native animals, some of which have been crossed with the finer breeds.

Beef cattle.—Cattle raised for the production of beef are almost all of the native type. They are pastured, or they graze on range lands in areas remote from the cities.

Sheep.—Relatively few sheep are pastured in the coastal areas on account of the high temperatures, and because the land can be more economically utilized for cash crops. The sheep are small in size and do not appear to thrive as well as goats.

Horses.—Horses are raised in large numbers on a number of haciendas, being pastured on alfalfa and para grass throughout the year. Where they are used as riding animals by overseers on haciendas, they are fed on alfalfa and other forage crops which are cut and fed green.

Donkeys.—Donkeys, known as burros in Peru, are pastured when not used as pack animals. Pack donkeys generally are fed cut alfalfa or para grass and algarroba pods. In the Piura region, donkeys feed principally on the native grasses which make their vegetative growth during the wet season and on algarroba pods during the dry season.

Hogs.—Hogs on some haciendas are pastured, but they are generally kept in small enclosures and fattened on maize or on broken rice. Shoats are fed also on yucca roots, *Manihot utilissima*, and on the sweet potato, *Ipomoea batatas*.

Classes of livestock in the sierra

Livestock indigenous to the region are the alpacas and llamas which had been domesticated by the Indians at the time of the conquest. The livestock at the present time consist principally of sheep, alpacas, llamas, beef and dairy cattle, donkeys, horses and hogs.

Sheep.—Sheep constitute the largest number of animals grazing on the range in the sierra. Although the range conditions are far from ideal, many animals are kept here. The range is characterized by a mixture of herbage, with grasses predominant.

Alpacas.—The alpacas graze especially in the puna, although some are found at lower altitudes with the sheep; alpacas, llamas, sheep and cattle can sometimes be seen grazing in the same areas.

Llamas.—Llamas are used as pack animals at high elevations and are permitted to graze at certain intervals en route. These animals are hardy and can thrive without food for days at a time.

Beef cattle.—Beef cattle in considerable numbers graze in the pampa areas of the sierra proper. Since there is not enough forage to fatten them, they are sold as feeder stock to be fattened on alfalfa pasture and maize in the canyons.

Dairy cattle.—The number of strictly dairy-type animals raised in the puna is relatively small. Most of the animals that are milked are dual-purpose dairy and beef animals. Near some of the larger centres of population in the canyons, purely dairy stock are kept.

Donkeys.—Next to llamas, donkeys are the most important pack animals in the sierra. Some animals receive cut green forage to supplement their grazing.

Horses.—Pasturage of horses is similar to that of donkeys in the sierra. Where the distances are long, horses are used by the drivers of pack trains of llamas.

Pigs.—Pigs (many of the razorback type) are generally turned out to find their own feed. Frequently, they are to be seen foraging with sheep and cattle.

Classes of livestock in the oriente

There are comparatively few domestic animals pastured in the oriente, in spite of the abundant vegetation. The principal kinds are cattle and hogs.

Cattle.—The few cattle in the region graze on the clearings in the forest or on the savannah areas.

Hogs.—Hogs of a long-haired type are found. Although seldom in good condition of flesh, they seem to subsist on the feed that is available to them. Generally they run loose about the habitation, or they may be tethered.

PASTURE AND RANGE HERBAGE

On account of the wide variation in temperature and rainfall, the botanical composition of pastures and ranges varies widely with the different regions.

Pasture and range herbage of the coastal region

The pastures and ranges of the coastal region vary in botanical composition in the different zones, comprising as above the northwest coastal zone, the zone of the lomas, natural coastal grasslands, irrigated pastures, and crop residue pastures (stubbles, etc.).

Pasture herbage of the northwest coastal zone.—This region is characterized by annual grasses which thrive during the rainy season of 3 months, from January to March. They grow from seeds which germinate following the first rains of the season and produce seeds again after the close of the rainy season. Other pasture herbage consists principally of browse. The principal grasses of the region are burgrass (*Cenchrus echinatus*), paja plumilla (*Aristida adscensionis*), lovegrass (*Eragrostis ciliaris*), and paraquita (*Chloris inflata*). Grasses of lesser importance are cordoncillo (*Anthephora hermaphrodita*) (*Bol. Dir. Gen. Agr.* 14 : 197-200 : 1943), horquetilla (*Chloris radiata*), stinkgrass (*Eragrostis cilianensis*), and *Leptothrium rigidum.* The last-named grass is perennial, all the others annuals. In some valleys are found sporadic stands of Natal grass, *Tricholaena repens* var. *rosea.* The reddish panicles of this species are ornamental and are frequently sold at the flower stalls in the public markets.

Low-growing plants eaten by the animals in this region are verdolga (*Portulaca oleracea*), yuca de caballo (*Proboscidea althaeifolia*), and yuca de monte (*Apodanthera biflora*), (*Bol. Dir. Gen. Agr.* 19 : 197-200 : 1943). Other plants browsed during the dry season are algarroba (*Prosopis chilensis*), faique (*Acacia macracantha*), sapote (*Capparis scabrida*), charan (*Caesalpinia corymbosa*), and overal (*Cordia rotundifolia*). Nearly all the species on which the animals browse are brushy plants which grow to large trees in protected situations where soil moisture is adequate.

Range herbage of the loma areas.—The loma areas are barren during the dry season, but become green during the months of October to December. Sufficient moisture is furnished by the mists, known as garuas or neblinas, for germination of the seeds and for growth of the grasses and other kinds of plants. Among the grasses of the lomas are cebadilla (*Bromus unioloides*) and maizillo (*Paspalum racemosum*). Several species of amaryllis are found in the region. The principal ones are amancae (*Chlidanthus fragrans*) and *Hymenocallis amancaes.*

Herbage of the natural grasslands along the coast.—The botanical composition of these grasslands, known locally as gramadales, supplied by subterranean water from adjacent rivers which cross desert lands, comprises principally salt grass (*Distichlis spicata*), known locally as grama salada, beach grass (*Sporobolus virginicus*), and grama bobo (*Paspalum vaginatum*). The grama salada grows in the driest parts where the water table is sometimes as deep as 2 metres below the surface. In sandy areas where wind sweeps over the surface, the grass catches the sand and holds it in dunes sometimes more than 5 feet in height, sending its stolons over the surface and being supplied with moisture from below through its deep rhizomes. Sometimes the wind blows the sand from the dunes at the base so that the mass of sand and vegetation on top of the dune will topple over toward the windward side. Beach grass is found in some places, but not in such large areas as grama salada. Both species are quite unpalatable and low in nutritive value. Grama bobo is found where there are supplies of non-saline water or non-alkaline water. Where the environment is favourable for its growth, it crowds out both grama salada and beach grass. Both goats and donkeys appear to thrive on pastures of grama bobo. Other herbage in areas near freshwater ponds and in small lakes of the gramadales comprise *Scirpus asper, S. limensis, S. californicus, Cladium mariscus,* and *Typha domingensis.* (Maldonado, Angel. Los Gramadales de la Costa del Peru. *Actos y Trabajos del Segundo Congreso Peruano de Quimica,* 1943.)

Irrigated pastures.—Irrigated pastures along the coast are planted either to para grass (*Panicum purpurascens*), known locally as gramalote, or to alfalfa. Where water is plentiful in hot coastal areas, para grass is planted because it produces the greatest tonnage of forage per

unit area. Para grass cannot be planted near some cities if the basin system of irrigation is used because a breeding place is provided for malarial mosquitoes. The cultivation of para grass is prohibited in the enclosed pastures (" invernas ") situated within a fixed radius of the municipality of Chiclayo if the basin system of irrigation is employed. It may be grown, however, under the ditch system of irrigation. (*La Vida Agr.* 18 : 73 : 1941.)

Crop residue pastures.—Crop residues are pastured in many areas. Following the harvest (1) the stubbles and volunteer vegetation may be pastured, (2) the loose, dry residues may be pastured, (3) or the fields may be cleaned of growing weeds, utilizing grazing animals in preparation for ploughing for the succeeding crop.

Rice stubble fields are generally pastured after the crop has been harvested. Many sprouts emerge from the base of the old plants. Such fields provide good pasture for dairy and beef cattle, especially in the region of Lambayeque, Piura, and Chiclayo. In places like Huaras, dry stubbles of wheat or barley are pastured.

The crop residues in cane fields are also used as pasture. Since sugar cane is harvested throughout the year, pasture is always available for a certain number of cattle.

After crops have been harvested, it becomes necessary to clean the fields for the next crop, or, as in the case of perennial Tanguis cotton, for the next ratoon crop. Such fields frequently have a considerable growth of weeds and other plants which are palatable to livestock, especially to goats. Plants found in such fields may comprise such species as Johnson grass (*Sorghum halepense*), a weed grass known locally as grama china, Bermuda grass (*Cynodon dactylon*), carretilla (*Medicago hispida*), *Panicum geminatum* near irrigation ditches, stinkgrass (*Eragrostis cilianensis*), paraguita (*Chloris inflata*), and many others.

Pasture and range herbage of the sierra

Pasture and range herbage in the sierra varies principally with elevation, topography, and moisture. The non-irrigated punas, hill tops, plains, lakeshores, cordillera, and the irrigated canyons have various species of herbage.

Herbage of the puna.—The species in the vegetation of the puna experience two seasons per annum, a cool humid season and a dry season when frosts occur ; the region then has the appearance of semi-arid steppes.

The grasses of the puna include : ichu (*Stipa ichu*), tisna (*S. brachyphylla*), paja blanca (*S. inconspicua*), chilligua chica (*Muehlenbergia peruviana*), pasto estrella (*Aciachne pulvinata*), quigua (*Sporobolus fastigiatus*), *Calamagrostis heterophylla*, grama real (*Distichlis humilis*), short grama or pat ckachu (*Poa annua*), chilligua (*Festuca rigescens*), and cebadilla (*Bromus unioloides*). Some wild clover, *Trifolium amabile*, is found in the puna (Gallegos, Jorge. Sheep Ranges of the Puna in Volume 1, Number 1. Lanares y Lanas, August, 1945, pages 18 to 20).

Pasture and range herbage of the mountain tops.—The pastures on sloping lands near the mountain tops consist principally of ichu (*Stipa ichu*), paja brava (*Festuca orthophylla*), grama real (*Distichlis humilis*), cebadilla (*Bromus unioloides*), short grama (*Poa annua*), and chilligua chica (*Muehlenbergia peruviana*) (Romero, Emilio. Monografía del Departamento de Puno, 1928, page 414). Some wild clover, *Trifolium amabile*, is found in the cultivated areas.

Pasture and range herbage of the pampas.—The high moist plains in the puna are known also as bofedales. If the pampa is surrounded by higher terrain, *Stipa ichu* and *Muehlenbergia peruviana* may predominate. If, on the other hand, it is the bottom of an old lake bed having

outwash soil deposited on a fairly level plain, the ichu is frequently missing and such species as *Distichlis humilis* and *Sporobolus fastigiatus* may predominate, as occurs in the region near Juliaca in the Department of Puno.

In general, the tall grasses, comprising *Stipa ichu* and some other clump-forming species, occupy the ground harmoniously with short stolon-forming species. After the clumps of tall grasses are one foot or more in diameter, the senescent portions in the centres die and decay, in many instances forming rings of grass shaped like atolls. After the rings become larger, stoloniferous species like *Muehlenbergia peruviana* find their way to the inside, occupying the spaces made vacant by the dying clump centres.

Herbage of the lakeshore.—One of the principal forage plants on the lake shores in high altitudes, especially on the shore of Lake Titicaca, is totora (*Scirpus riparius*), which is sought eagerly by alpacas and cattle when no other forage is available during periods of drought.

Range herbage of the cordillera.—This herbage consists principally of short grasses, such as *Calamagrostis vicunarum, C. preslii, Trisetum floribundum, Dissanthelium calycinum,* and *D. minimum.* These grasses are available only during the season when the ground is moist and not covered with snow.

Pasture herbage of the canyons.—These pastures consist principally of planted alfalfa, planted ryegrass (*Lolium italicum*) and volunteer vegetation which invades the pasture and crop areas. The volunteer species comprise principally Kikuyu grass (*Pennisetum clandestinum*), white clover (*Trifolium repens*), wild annual sweet clover (*Melilotus indicus*), black medic (*Medicago lupulina*), and carretilla (*Medicago hispida*). There are also some wild oats (*Avena fatua*) and wild mustard (*Brassica nigra*). Where alfalfa is grazed heavily, it is invaded and ultimately crowded out by Kikuyu, much as Kentucky bluegrass (*Poa pratensis*) invades alfalfa pastures in some sections of the United States. Kikuyu grass is a comparative newcomer in the canyons in Southern Peru. It was introduced in trial plots at the Chuquibambilla Experiment Station in 1923, escaped from cultivation, and is now found in many areas along the Southern Railway.

In some of the canyons, like the valley surrounding Cajamarca, where spring rains are sufficient during a period of approximately 3 months to grow a crop of wheat, barley or potatoes on the slopes, only the pastures in the lowlands are irrigated in order to ensure pasturage for dairy cattle throughout the year. Where such pastures are seeded to ryegrass and grazed for several years, they are invaded by white clover.

The wheat lands in the region of Arequipa frequently have a heavy stand of volunteer annual wild sweet clover which is pastured after the wheat has been harvested. In some of these fields there is also a heavy stand of volunteer carretilla (*Medicago hispida*).

Pasture herbage of the eastern region

The pasture herbage of the east varies principally according to topography. Since the region is typically tropical from the standpoint of temperature and rainfall, leguminous forage crops do not play an important role in the pasturage. The reasons are not far to seek. In the grass-legume mixtures of temperate climates, one finds plants of similar growth habits. For example, red clover (*Trifolium pratense*), alfalfa (*Medicago sativa*), and timothy (*Phleum pratense*) are clump-forming and grow to approximately the same height. Therefore, they grow readily in association without encroaching too much upon one another. Kentucky bluegrass (*Poa pratensis*) and white clover (*Trifolium repens*) are rhizomatous and stoloniferous respectively. Both are comparatively short and grow well in association where pastures are

grazed short, but not too short. Kentucky bluegrass crowds out red clover and alfalfa in pastures due to selective grazing and the spreading habit of the bluegrass by rhizomes, which gives it an advantage over the legumes.

In the tropics there are additional problems. No satisfactory leguminous species are available corresponding to the legumes of the temperate zone, like the clovers and alfalfa. When planted in the tropics, clovers and alfalfa are out of their native habitat and must compete with tropical grasses better adapted to the environment. Such tropical grasses are extremely aggressive. The clump-forming species like guinea grass (*Panicum maximum*) and jaragua (*Hyparrhenia rufa*) grow tall. Stoloniferous species like para grass, Kikuyu grass and serillo (*Paspalum conjugatum*) invade areas rapidly and climb over the tops of leguminous plants. The few species of legumes like the pega pegas (*Desmodium polycarpum, D. purpureum* and *D. adscendens*) which grow wild in grasslands are not aggressive. Practically all the pasture herbage of the east consists of species of grasses varying according to topography, rainfall and altitude.

Pasture herbage of the lowlands.—The lowland pasture herbage consists principally of *Panicum purpurascens*, a grass which thrives well and forms one of the most important pasture species in the stream bottom lands not covered by forests.

Pasture herbage on slopes.—The principal pasture grasses on rocky mountain slopes in the Chanchamayo region are *Axonopus scoparius* and gordura (*Melinis minutiflora*). The latter forms a dense growth, especially on slopes that are burned over during the dry season. Despite reports to the contrary, gordura does not repel mosquitoes, ticks or snakes. This grass does not grow in the wet ground where mosquitoes breed. Cattle kept on gordura pasture are likely to be free from ticks, but this is not because it kills the ticks. Ticks drop from the animals to the ground when mature and the infant " seed ticks " climb the vegetation and attach themselves to passing animals. In the case of gordura, however, seed ticks as well as dust are caught in the gummy, velvety foliage and do not transfer to browsing livestock. (Chase, Agnes. Grasses of Brazil and Venezuela. In *Agriculture in the Americas*. 4 : 123-126 : 1944.)

Pasture herbage on mountain tops.—The principal species on low mountain tops subject to fogs, grama negra (*Paspalum notatum*), constitutes a dependable pasture forage in the eastern foothill region of the Andes Mountains.

Pasture herbage on cultivated lands.—The volunteer grasses which appear first on retired cultivated lands in the Tingo Maria area are Bermuda grass (*Cynodon dactylon*), torurco (*Paspalum conjugatum*), and nudillo (*Axonopus compressus*). (*La Vida Agr.* 20 : 679 : 1943.) In some places such as fruit plantations of the Chanchamayo region, there are extensive and undesirable stands of sujo, a species of *Imperata*, probably *I. brasiliensis*. The planted pasture grasses are para grass and guinea grass. The principal pasture grass in the Madre de Dios region is *Axonopus compressus*, comprising approximately 80 per cent of the botanical composition of the pastures on lands that formerly were covered by forests. Some jaragua (*Hyparrhenia rufa*) and guinea grass (*Panicum maximum*) have been introduced. The most valuable grass in the Iquitos region is *Panicum maximum*.

PASTURE SUPPLEMENTS

Feeds consisting principally of green forage are given extensively to dairy cattle, pack animals and riding horses along the coast. On large haciendas, nearly all green forages are run through ensilage cutters before feeding. Dry concentrated feeds are utilized wherever they are available.

Pasture supplements in the coastal area

The principal supplemental feeds in the coastal area are maize fodder, green para grass, green alfalfa, alfalfa hay, sweet potato vines, sunflower plants, silage, maize grain, bran, cottonseed meal, cottonseed cake, linseed cake, powdered and broken rice, barley grain, draff, and algarroba pods.

Maize fodder (chala) is grown extensively for feed along the coast. It is planted in all months of the year except December, January and February. During these three months, two species of insects, the stem borer (*Diatrae saccharalis*) known locally as gusano barrenador del tallo, and the leaf worm (*Laphigua frugiperde*), known locally as gusano de hoya, are destructive. Fodder maize is planted much denser than maize for grain, in order to produce the maximum amount of forage.

Panicum purpurascens is one of the principal forage grasses grown in the irrigated lands along the coast. It can be cut three to four times a year and the yields are reported to be high (*La Vida Agr.* 17 : 90 : 1940). Para grass is cut instead of being pastured along the coast because (1) cattle ticks are not so likely to be spread, and (2) it is more economical to feed in this manner than it is to permit the cattle to graze the areas. It is estimated that only 60 per cent of the potential yield is recovered by grazing. In the Chiclayo region, this species constitutes the pasturage of the invernas or enclosed pasture fields which are utilized for finishing feeder cattle coming from higher altitudes in Peru and sometimes from Ecuador.

It is reported that 90 per cent of the alfalfa hay comes from the vicinity of Supe. Much of the alfalfa hay fed to dairy stock is run through the feed cutter and used as a dry feed mixed with concentrates.

Sweet potato vines or camote (*Ipomoea batatas*) form a desirable green forage to supplement the pasturage. A variety which produces a large amount of forage is utilized. Yields on irrigated land along the coast are reported to average 20 metric tons per cut per hectare. The vines can be cut three times a year.

Sunflower plants have come to be used as fodder only quite recently. Although not so easy to handle as maize, they provide feed during the period when maize suffers severe attacks by insects.

Maize silage is made on some of the large haciendas along the coast. It is prepared during the cool months of the year and is fed during the hot summer months when maize in the field is subjected to severe insect attacks. Maize grain is purchased by dairymen and hog raisers whenever the price is economic. It is ground and mixed with bran and chopped alfalfa hay.

Cottonseed cake is one of the important concentrates used on the dairy farms supplying raw milk for city consumption. Comparatively little linseed meal is available since the flax grown in Peru is a fibre flax and not a seed flax. The yields of seed are low.

A considerable quantity of by-products of rice hulling, such as rice powder and broken rice, known locally as ñelen, are used as feed for livestock, mixed with bran or other ground feed for cattle and hogs. Some hog raisers finish their hogs on ñelen instead of maize.

Barley from the sierra is sometimes available in small quantities for use as a concentrated feed. Some dairymen also purchase draff, a by-product of local breweries, and use it as a concentrated feed. Bran is obtained from flour mills in quantities insufficient to supply the needs of the dairymen in the vicinity of the cities along the coast.

Some dairymen feed ground algarroba pods produced principally in the vicinity of Chiclayo. These pods are high in sugar content and are relished by dairy stock, as well as by horses and

donkeys. In 1942, the coastwise shipments of algarroba pods from the Port of Eten to Callao exceeded 1,000 metric tons.

Limited quantities of commercial feeds are compounded and sold to the dairymen and poultrymen under various trade names, such as Vita-ova, calf manna and molascuit.

Pasture supplements in the sierra

The pasture supplements in the sierra differ from those used along the coast. There is also some difference in the kinds of supplement used as between the regions of higher altitude and the quebrada regions. The pasture supplements in the sierra include barley straw, oat hay and oat silage at the higher elevations, and alfalfa, maize stover and barley grain at the lower elevations.

Barley straw is utilized for feed during the drought season, especially in the Department of Puno. When the barley crop is poor in the rainy season and pastures become extremely short during the following dry season, there is danger of loss of animals from starvation.

Some oat hay is made at high altitudes where the temperature is too low for the production of grain. The making of oat hay is limited to some of the large haciendas. Some oat silage is produced in the same regions as oat hay in silos of the trench or tower type. There are comparatively few silos in the sierra.

Alfalfa is grown extensively in the quebradas ; that which is not pastured is cut and fed green to animals. Some hay made in this region is sold along the coast, especially for feeding army horses.

Dry maize stover, chala seca, is fed to dairy cattle on some farms before the animals are taken to graze each day on alfalfa pastures, a practice which, it is claimed, prevents bloating.

Some barley grain is used as a concentrated feed for livestock, but most is used for human consumption in the form of toasted barley.

Pasture supplements in the oriente

There is comparatively little feed produced in the eastern region to supplement pastures. The principal pasture supplements are elephant grass (*Pennisetum purpureum*), Guatemala grass (*Tripsacum laxum*), para grass (*Panicum purpurascens*), and guinea grass (*Panicum maximum*), all of which can be cut and fed green. The para and guinea grasses are generally pastured.

Elephant grass is probably the most desirable grass for supplementing pastures in the selva region. It can be cut every 3 months for use as fairly palatable and nutritious green feed.

POISONOUS PLANTS

The poisonous plants found on the grasslands, particularly in the mountains, are not eaten by livestock unless the grasses become extremely short. Among the poisonous plants most harmful to livestock are garbancillo (*Astragalus officinalis*), boton boton (*Hymenoxys haenkeana*), cejamata (*Nicotiana glauca*), cicuta or kita-anis (*Conium maculatum*), kura (*Urtica echinata*), miyo-miyo (*Coriaria thymifolia*), chamba (*Leucaena trichodes*) and borochero (*Ipomoea carnea*).

Astragalus officinalis (juscka) is common in the range lands of the mountains, but is reported to be harmful to horses, cattle and sheep only when there is selenium in the soil. Horses that feed on it become blind and stupefied, decline in weight, become unfit for work and finally die. Cows that eat it give milk that is bitter in taste. Sheep will not eat it if other feed is available. When they once start eating it, they become addicted to it. To determine if sheep are poisoned, they are put in an enclosure and fed with the plant. If they show a preference for it, they are addicted to it and have been poisoned by it.

Hymenoxys haenkeana is reported to be harmful to both cattle and sheep. *Nicotiana glauca* is unpalatable to animals. If hungry sheep are forced to eat it, they die. The root of *Conium maculatum* is poisonous. Generally, it is not likely to be dangerous because it grows in moist situations where other sheep fodders are available ; the tops are said to be distasteful and not very harmful. *Urtica echinata* has stinging hairs which cause harm as a contact poison to the skin of animals. *Coriaria thymifolia* is poisonous to animals of the alpaca family.

The leaves and tender branches of *Leucaena trichodes* can be used for feeding sheep, goats and cattle. Horses and donkeys that feed on them lose the hair of their manes and tails. *Ipomoea carnea* is found in the Piura region. It grows as a shrub until it is approximately 4 feet high and the branches then continue as vines. The symptoms of poisoning resemble those caused by eating *Astragalus officinalis*.

PASTURE AND RANGE MANAGEMENT

The management of pastures and ranges varies in different parts of the country. Little attention is given to the management of range lands. Cultivated pastures are found principally on the west coast and in the canyons of the mountains, where pasture lands are frequently irrigated while crop lands on areas of rough topography planted to crops like potatoes and barley which grow during the short rainy season are not irrigated.

Pasture management in the coastal area

A number of dairies near the larger centres of population, having as many as 500 to 1,300 head of cattle, frequently have no pasture for the animals. All forage is cut and fed green after running it through an ensilage cutter. Some dairy animals on smaller haciendas are pastured on alfalfa and para grass.

Alfalfa is utilized as a pasture crop by some of the dairies. It is grown in rotation with cotton on some haciendas. Where it is overgrazed, it is crowded out by Bermuda grass.

Pastures of para grass (*Panicum purpurascens*) in the coastal area provide the largest amount of dependable forage. Even if overgrazed, they recover after irrigation. The quality of the pasturage is poor in comparison with that of alfalfa. It is believed that this grass harbours cattle ticks more than alfalfa pastures. Para grass pastures are found in the invernas or enclosures where feeder cattle from the mountains are finished for the market. Native beef and dairy animals, as well as horses, are also pastured on para grass.

The crop lands are pastured following the removal of the crops. No special attention is given to such pasture areas. If the land is not fenced, one or more herders accompany the herds and flocks. Animals on pastures of this type are utilized to clean the land of weedy vegetation in preparation for the next crop, particularly on cotton lands after the crop has been harvested. Owners of large flocks of goats, sometimes as many as 500 or more in a flock, drive the animals into the field. Herders camp with the flocks and are in attendance day and night until the fields have been cleaned of everything that may be edible. A typical transaction for pasturage of this type is that owners of goats pay five centavos per head ($0.0077, U.S. currency) for the privilege of pasturing them until the field has been cleaned.

Pastures following a crop of rice are known as stubble grazings. The second growth of plants from the rice stubble forms desirable pasturage for cattle and horses.

Natural grazing lands in the coastal area, principally in the region from Chiclayo to Piura where rain falls during 3 months of the year, receive little attention as to management. Although some beef cattle are pastured, most of the grazing animals are goats which are pastured in large

flocks. Two herders are required to take care of a flock of 1,000 goats. They generally follow the flocks on the back of a donkey. The animals roam over a large territory, but are brought back to the river in the afternoon for water.

No care is given to the grazing lands in the garua (mist) areas. Herds of cattle and flocks of goats are brought to the areas accompanied by herders during the time of the fogs, remain there as long as there is forage for the animals, and are removed as soon as the grazing grounds become barren again.

The vegetation of the grazing areas supplied by subterranean moisture in the saline sandy soils along the coast consists principally of *Distichlis spicata, Sporobolus virginicus* and *Paspalum vaginatum*. These grasses are low in palatability and no attention is given to management of grazing. Cattle or goats are grazed whenever there is enough grass to provide some forage.

Pasture and range management in the sierra

The pastures in the canyons are on cultivated lands or on lands suitable for cultivation, while those of the punas are in areas frequently not suited to the production of crops. The planted pastures in the canyons consist principally of alfalfa and ryegrass.

Alfalfa pastures. In the region of Arequipa, dairy cattle are tethered on alfalfa pastures. The animals are tied to stakes with ropes about 20 feet in length and moved forward to an ungrazed area daily. After they have completed the area they start again from the beginning where the plants have had an opportunity to recover. In this region the normal life of an alfalfa stand has until recently been 5 to 6 years. Stands do not now generally last more than 2 or 3 years, due to the spread of what the landowners call a noxious weed, " sudan negro," known in other regions as Kikuyu grass (*Pennisetum clandestinum*). Some farmers have found that the fields can be cleaned by using a special harrow and the stands of alfalfa made to last longer.

Frequently some of the cattlemen in the Arequipa area buy what is known as one cutting of alfalfa. The livestock are put on the field and, by means of moving the stakes to which they are tethered, graze across the field. The entire crop which is in the field is thus removed. The charge for a " cutting " or grazing in this manner varies considerably with different seasons of the year, depending upon the abundance of alfalfa and also upon the demand, which sometimes fluctuates very widely. When livestock, either cattle or sheep, are brought down from the sierra for fattening, the price of pasture may increase overnight to more than double the price of the preceding day. Generally, the price from January to May is 30 to 35 soles per topo (approximately $5.60 to $6.40, U.S. currency, per acre), and reaches a maximum of approximately 140 soles per topo in October. A yearly average is probably from 60 to 70 soles per topo. Alfalfa in the area generally can be cut, or pastured down completely, five or six times a year. Feeder cattle run loose on the pastures. As fences are absent in some areas, the herdsmen remain with the animals both day and night.

In the region of Cajamarca, the pastures in the canyons are seeded to alfalfa or to ryegrass or a mixture of the two, to provide pastures which are grazed for a number of years. The alfalfa gradually disappears in some areas and white clover invades the pastures.

Range lands.—The range lands of the puna are given no special attention other than burning at the close of the dry season. The owner of the herds or flocks generally grazes all his animals. In general, the alpacas graze at the highest elevations, with the llamas, sheep and beef cattle at lower elevations in the order named. Frequently one may find all species of livestock in the area. There are two general classes of grasses in the sierra, tall grasses comparatively low in

palatability, and short grasses yielding only a small amount of pasture, but of higher palatability than the tall grasses among which they grow. The tall grasses are clump-forming species, while many of the short grasses propagate by creeping stolons which root at the nodes. In nature, the advantage of this combination is that it tides the animals over from one season to the next. Cattle, sheep, llamas and alpacas do not relish the tall grasses. If there were only highly palatable short grasses, the animals would eat everything during the rainy season and there would be no forage of any kind during the dry season. The two types of grasses, differing widely in palatability, supply relatively abundant pasture during the rainy season and the animals can persist over the dry period on the less palatable species.

Although some of the large haciendas in the sierra own as many as 150,000 sheep, they generally herd them in flocks of not more than 400 animals. Sheep of different ages and sexes are usually segregated. In addition to the shepherdesses who follow the flocks on foot, there is generally one caretaker or quipo on each hacienda who goes on horseback from one flock to the next to take care of sick animals and to attend to other problems. The wages of the shepherdesses, in 1943, were approximately 15 soles per month (equivalent to $2.31 U.S. currency) and they were in addition permitted to keep approximately 300 sheep of their own on some remote part of the hacienda. On one of the haciendas, the owner is said to have 40,000 sheep, while the Indian families who take care of his flocks are pasturing 80,000 of their own sheep on other parts of the hacienda.

In most sections the Indians burn the range, especially on mountain slopes, at the close of the dry season. This has disadvantages as well as advantages. One of the disadvantages is that it kills the less palatable species which have always been the Indians' safeguard from the standpoint of furnishing subsistence forage during the dry periods. If the species low in palatability was not in reserve, many animals would die of starvation each year during the periods of drought. Burning has the advantage of liberating mineral salts, found in the ashes of the dry herbage, making them available for the new growth of grasses.

Pasture management in the east

In the selva and foot-hill regions some animals on small holdings are tethered. Those that graze in fenced pastures run loose. These lands are expensive to clear and it has not in general been found profitable to clear land for pasture only. The most dependable species of pasture grass, especially in lowlands, is *Panicum purpurascens*, which needs little care from the standpoint of management. On the slopes, *Panicum maximum* is a more desirable pasture, but careful management is necessary to prevent its extermination by overgrazing.

RELATIVE PALATABILITY OF PASTURE AND RANGE HERBAGE

There is a wide range in degree of palatability of pasture and range herbage. Most cattle do not at any time relish certain plants, such as *Stipa ichu*, although it is reported that Brown Swiss cattle can thrive on this species and Holsteins do not. Other plants such as alfalfa are always relished by all kinds of livestock. In some instances, certain species, for example *Melinis minutiflora*, are relished after the animals have become accustomed to them.

Little difficulty is experienced along the coast in obtaining palatable forage for livestock. The types of forage which are high in palatability are alfalfa, green maize fodder and sweet potato vines. Although para grass is not as palatable, it ranks high when compared to some of the forage plants of the sierra.

The range plants of the sierra region are probably the lowest in palatability, but must be utilized in the absence of more desirable species. The short grasses of the puna are most palat-

able, while species like *Stipa ichu* are lowest in palatability. The numerous weedy plants in some parts include jankas-ckera (*Lupinus humifusus*), jattaco (*Amaranthus spinosus*), canlli (*Margyricarpus pinnatus*), and zunchu (*Wedelia hispida*). In the canyons, alfalfa is higher in palatability than Kikuyu grass and is therefore eliminated in heavily-grazed pastures through selective grazing.

Probably the most palatable pasture grass on large areas in the selvas is guinea grass. There are many other palatable species, but the quantity of feed obtainable from them is small. In general, para grass is the most important grass in the region. *Melinis minutiflora* is relished by livestock after the animals become accustomed to it. The first grasses that make their appearance in fields retired from cultivation are generally *Paspalum conjugatum* and *Axonopus compressus*, both of which are relatively low in palatability. In the Chanchamayo region, a species of *Imperata* relatively low in palatability has invaded some of the orange groves.

GRAZING CAPACITY

The grazing capacity of pastures and ranges varies in different parts of the country. Except on desert lands and on snow-covered mountains, where the grazing capacity is *nil*, it is probably lowest in the grazed land in the high sierras and highest in the irrigated areas in the vicinity of Arequipa.

In the coastal region near Piura, less than one goat can be pastured per 2 hectares (one hectare = 2.47 acres). It is estimated that, on some alfalfa pastures under irrigation, ten animals can be pastured per fanegada (one fanegada = 7 acres approx.). In some sections of the irrigated coastal lands, it is estimated that the grazing capacity of para grass is on an average 1.8 full-grown cows per hectare.

In the sierra region, the number of sheep and alpacas in the puna is estimated at two animals per 3 hectares and the number of cattle at one animal per 2 to 4 hectares. In many places, much larger areas are required per animal. The holdings in the Department of Puno have been overgrazed ; some have up to five sheep per hectare where the grazing capacity is only one or two sheep per hectare (*La Vida Agr.* 16 : 595 : 1939). In the canyons where animals are tethered, the number of dairy cows that can be grazed on alfalfa pasture is estimated at one cow per topo (equivalent to 0.89 acre). Beef feeder stock require 30 topos of alfalfa per 100 head for three months.

In the vicinity of Oroya, Department of Junin, the grazing capacity of range lands is estimated to be 12 to 20 head of cattle, or the calculated equivalent which is estimated to be 120 to 200 sheep per square kilometre. The estimated rental value of range lands is 60 to 100 soles per square kilometre a year or a general average of 5.00 soles per head of cattle and 0.50 sol per head of sheep. (One sol is equivalent to 15.4 cents, U.S. currency.) It has been claimed that the smoke from the plant of the Cerro de Pasco Copper Corporation contained sulphur dioxide and arsenical gases in sufficient quantity to destroy the grazing in the vicinity, resulting in a number of indemnity claims against the Corporation.

One of the grazing zones comprising 759 square kilometres contained an area of 149 square kilometres which suffered damage to the extent of 100 per cent. Another zone comprising 1,599 square kilometres contained an area of 937 square kilometres which suffered damage to the extent of 100 per cent and the remainder from 5 to 30 per cent. It is reported that the only grass species which survived in some areas was *Distichlis humilis*. The indemnity claimed on the areas suffering 100 per cent damage was 60 soles per square kilometre annually (*La Vida Agr.* 19 : 421 : 1942). With the installation of the Cottrell system, the smoke damage is reported to have been eliminated.

In the east, it is difficult to estimate the grazing capacity. At the Agricultural Experiment Station at Tingo Maria, it is estimated that under proper management three animal units can be pastured per hectare on para grass. An animal unit as used in this region is equivalent to one head of beef or dairy cattle over 2 years of age; two animals over 1 year of age and under 2 years; or four animals under 1 year of age.

In the selva region near Iquitos, the grazing capacity is estimated to be one animal per hectare (*La Vida Agr.* 20 : 670 : 1943).

OUTLOOK

Methods of improving the pastures and rangelands of the country include: (1) practising rotational grazing in native pastures, (2) supplementing native pastures with other forage during the dry season of the year, (3) planting species that will yield a larger amount of forage, and (4) the application of fertilizers.

Along the coast, the pastures which can be established most easily are those planted to para grass (*Panicum purpurascens*). There are some good pastures of guinea grass (*Panicum maximum*) and Rhodes grass (*Chloris gayana*). Although guinea grass and Rhodes grass are more difficult to establish and maintain than para grass, the forage obtained from the first two species when once established is of better quality. Nearly all rangelands in the sierra, especially at higher elevations, are overgrazed. By giving grazing lands a rest period from time to time, the more palatable species of pasture herbage would be able to recover.

In most regions of the sierra, there are several months of extreme drought each year. If animals were given supplemental feeds during this period, the grasses and other herbage need not be grazed so closely. Some supplemental forage in the form of barley straw is fed to flocks of sheep owned by the Indians in the Puno region. Some of the haciendas feed oat silage and barley silage during critical pasture periods. The production of oat hay could be increased.

Better species of grasses and legumes planted in pasture and range areas in the sierra would improve the grazing capacity. Some plantings have already been made, but only on a comparatively small scale. The principal plantings include ovillo or orchard grass (*Dactylis glomerata*), English ryegrass (*Lolium perenne*), and Italian ryegrass (*Lolium italicum*).

In the selva region, the most common pasture grass is *Panicum purpurascens*. The upland pastures could be improved by planting *P. maximum* and *Hyparrhenia rufa*.

A decree, dated June 6, 1941, provided for loans by the Banco Agricola to persons who desire to use the funds to improve pastures. Various agricultural experiment stations, especially those located at La Molina, Tingo Maria, Huaraz and Chuquibambilla, are conducting experiments on pastures. Some of the results have been published (*Est. Exp. Agr. La Molina, Mem.* 10a : 137-139 : 1937). It is reasonable to assume that, if a systematic procedure to improve the pasture lands were followed, the number of animals that could be grazed per unit could be increased considerably.

SUMMARY

For the purpose of studying the forage resources of Peru, the country may be divided into three geographic regions, namely, the Coastal Region, the Sierra, and the Oriente, known also as the Montaña. In the coastal area, most of the forage lands are irrigated. In the Sierra, the range lands in the treeless mountainous areas are non-irrigated. Forage production is on an intensive scale on the coast, while on the range lands in the Sierra it is on an extensive scale. Only limited areas in the Oriente are utilized for forage since the land is covered by tropical rain forest vegetation.

Along the coast, forage is produced principally as a feed for dairy cattle. In the Sierra, native range grasses supply forage for sheep, llamas, alpacas and some beef and dairy animals.

The kinds of forage grown along the coast are principally alfalfa and para grass supplemented by maize, which is cut and fed in the green state. The native range lands of the Sierra produce various species of grasses, which may be classified into two general groups, namely, tall grasses, low in palatability, and short grasses, which are more palatable than the tall grasses. Tropical rain forest species of grasses comprise the principal forage in the Oriente.

Alfalfa hay is made in the river valleys along the coast and in some of the valleys of the Sierra. Little attention is given to range land management in the Sierra and to grassland management in the Oriente. On the other hand, pastures are well-managed on some of the irrigated lands along the coast and in the valleys of the Sierra where many of the dairy cattle are tethered on alfalfa pastures. In the Cajamarca Valley, the pasture lands located in the bottoms of valleys are irrigated, while wheat and barley located on the slopes are grown without irrigation. In the Sierra, where sheep herding is the most important industry, the animals are on the range throughout the year. Each flock is generally herded by one or two Indian shepherdesses.

The grazing capacity of pasture and range lands varies with the regions. In the coastal region near Piura, less than one goat can be ranged on two hectares of non-irrigated land. On the other hand the number of cattle that can be pastured on some alfalfa lands under irrigation is estimated to be 10 animals per 3 hectares. In the Sierra, the number of sheep or alpacas that can be ranged on the puna lands is estimated to be two animals per 3 hectares. In many sections, much larger areas are required per animal. In the quebradas, where animals are tethered, the number of dairy cows that can be grazed on irrigated alfalfa pasture is estimated at 1 cow per topo. (One hectare is equivalent to approximately 2.75 topos.) Beef feeder stock require 30 topos of alfalfa pasture per 100 head for 3 months.

In the Oriente, it is difficult to estimate the grazing capacity. At the Tingo Maria Agricultural Experiment Station which is located in the Oriente, it is estimated that under proper management three animal units can be pastured per hectare on para grass. An animal unit as used in this region is equivalent to one head of beef or dairy cattle over 2 years of age ; two animals over 1 year of age and under 2 years ; or four animals under 1 year of age.

RESUMEN

Con el propósito de estudiar las fuentes de forraje del Perú podemos dividir el país en tres regiones geográficas, a saber, la Costa, la Sierra y el Oriente, conocido tambien como la Montaña. En la costa casi todas las tierras dedicadas al forraje están bajo irrigación. En la Sierra los terrenos en las regiones montañosas desnudas de árboles no están bajo irrigación. El forraje se produce intensamente en la costa y extensamente en la Sierra. En el Oriente solamente se utilizan áreas muy limitadas para forraje porque éstas están cubiertas por bosques de vegetación tropical.

En la costa el forraje se produce principalmente como alimento para ganado vacuno. En la Sierra los pastos naturales de la montaña suplen forraje para las ovejas, llamas, alpacas y algun ganado.

El forraje cultivado principalmente en la costa es la alfalfa y yerba para, ademas del maíz que es cortado verde y usado conjuntamente con la alfalfa y yerba. Los terrenos montañosos de la Sierra producen varias especies de yerba que se pueden clasificar en dos grupos generales, a saber, yerbas largas poco gustosas, y yerbas cortas que son más gustosas que las yerbas largas. Las especies de pasto de vegetación tropical comprenden el principal forraje del Oriente.

La alfalfa crece en los valles aluviales de la costa y en algunos de los valles de la Sierra. Se da muy poca atención a la manutención del forraje en la Sierra y de los pastos en el Oriente. Sin embargo en algunos de los terrenos de la costa que están bajo irrigación y en los valles de la Sierra, donde gran parte del ganado es alimentado con alfalfa, los pastos son bien conservados. En el valle Cajamarca los pastos que queden en las hondonadas del valle están bajo irrigación mientras que el trigo y la cebada que están en los declives son cultivados sin irrigación. En la Sierra, donde el pastoreo de ovejas es la industria más importante, los animales pacen en las montañas durante todo el año. Cada manada es pastoreada por uno o dos pastores indios.

La productividad de los pastos en los terrenos montañosos varía de acuerdo con la región. En la región de la costa cerca de Piura, menos de una oveja puede apacentarse en dos hectáreas de tierra no irrigada. Sin embargo, se calcula que el número de ganado que puede apacentarse en algunos terrenos de alfalfa bajo irrigación llega a 10 animales cada tres hectáreas. El número de ovejas o alpacas que puede apacentarse en las punas de las Sierra se calcula que es de dos animales por cada tres hectáreas. En muchas secciones se requiere mayor extensión de terreno por animal. El número de vacas que puede pacer en los pastos de alfalfa situados en las quebradas se calcula en una vaca por topo. (Una hectárea equivale aproximadamente a 2,75 topos.) El ganado apacentado para matanza necesita 30 topos de alfalfa por cada cien cabezas cada 3 meses.

Es difícil calcular la productividad de los pastos en el Oriente. En la Estación Experimental Agrícola de Tingo María, situada en el Oriente, se calcula que bajo buen manejo se pueden apacentar tres unidades por hectárea de yerba para. Una unidad, en esta regíon, equivale a una cabeza de ganado para matanza o ganado lechero de más de dos años ; dos animales de más de un año y menos de dos años de edad ; o cuatro animales de menos de un año de edad.

SUMARIO

Com o propósito de estudar as fontes de forragem do Perú, podemos dividir o país em três regiões geográficas, a saber : 1) *Costa*, 2) *Serra* e 3) *Oriente*, conhecido tambem como *Montanha*. Na região da Costa, quasi todas as terras dedicadas a forragem estão sob irrigação. Na região da Serra, as terras de pastagem nos terrenos desnudos de árvores nas áreas montanhosas não estão sob irrigação. A forragem se produz intensamente na Costa e extensamente na Serra. No Oriente, sómente se utilizam áreas muito limitadas para forragem, porque estas estão cobertas de bosques de vegetação tropical.

Na Costa, a forragem se produz principalmente como alimentação para gado vacum. Na Serra, os pastos naturais da montanha servem de forragem para os carneiros, lhamas, alpacas e algum gado.

A forragem cultivada na Costa e principalmente a alfafa e o " capím para," além do milho, que é cortado verde e usado conjuntamente com a alfafa e o capím. Os terrenos montanhosos da Serra produzem várias espécies de capím que se podem classificar em dois grupos gerais, a saber : capím comprido, pouco gustativo e capím curto, que e mais gustativo que o capím comprido. As espécies de pasto de vegetação tropical compreendem a principal forragem do Oriente.

A alfafa cresce nos vales aluvianos da Costa e em alguns dos vales da Serra. Dá-se muito pouca atenção a manutenção da forragem na Serra e dos pastos no Oriente. Não obstante, em alguns dos terrenos da Costa, que estão sob irrigação, e nos vales da Serra, onde grande parte do gado e alimentado com alfafa, os pastos são bem conservados. No vale Cajamarca, as terras de pastagem, que estão situadas nos lugares mais profundos do vale, estão sob irrigação, enquanto que o trigo e a cevada, que estão nos declives, são cultivados sem irrigação. Na Serra,

onde a pastoreação do gado ovino é a indústria mais importante, os animais apascentam nas montanhas durante todo o ano. Cada rebanho é pastoreado por um ou dois pastores indios.

A produtividade das terras de pastagem nos terrenos montanhosos varia de acordo com a região. Na região da Costa, perto de Piura, menos de uma ovelha pode ser apascentada em dois hectares de terra não irrigada. De outra parte, calcula-se que o número de gado que pode ser apascentado em algumas pastagens de alfafa sob irrigação atinge a 10 animais em cada três hectares. O número de ovelhas ou de alpacas que podem ser apascentadas nos terrenos áridos (puna) da Serra pode ser estimado em dois animais em cada três hectares. Em muitas zonas são necessarias maiores áreas por animal. Nos declives, onde os animais são peados, o número de vacas leiteiras que podem ser apascentadas nas irrigadas pastagens de alfafa é estimado em uma vaca por topo (um hectare equivale aproximadamente 2,75 topos). O gado apascentado para córte necessita 30 topos de pastagem de alfafa para 100 cabeças, cada três meses.

É dificil calcular a produtividade dos pastos na região do Oriente. Na Estação Experimental Agrícola de Tingo Maria, situada no Oriente, foi calculado que, sob adequado trato, três unidades podem ser apascentadas por hectare de " capím para." Uma unidade, usada nesta região, equivale a uma cabeca de gado de córte ou de gado leiteiro, de mais de dois anos ; dois animais de mais de um ano e menos de dois anos ; ou quatro animais de menos de um ano de idade.

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